

able rival in the matter of wheat-growing. A short seven years has greatly altered his feelings in this respect, and we are probably right in considering that the far East is destined to do its part in forcing down the price of wheat to as great a degree as the land of the setting sun. The *brochure* before us is a thoroughly dry statement of facts composed of numbered despatches, letters, and tables, all bearing upon the capabilities of India as a wheat-producing country. The reader will not, however, obtain information as to extent or area, except in a more or less incidental manner. The principal matters dealt with are (1) the quality and comparative values of the various wheats grown; (2) the modes of cultivation pursued; (3) the nature of the soils on which wheat is grown; (4) the average yield per acre; (5) the effects of continuous wheat-growing in diminishing yield; and also other matters relating to the details of wheat-cultivation in India.

With regard to the quality of Indian wheats there is no room for doubt. The conclusions arrived at are based upon actual weight per bushel, value upon the Corn Exchange at Mark Lane, and an elaborate report upon milling and bread-making results furnished by Messrs. McDougall Brothers of 10, Mark Lane, London. From whichever of the above points of view we test the quality of the Indian wheat, the result is equally satisfactory, and the more so when we find that from year to year the samples and bulk continue to improve. Messrs. McDougall Brothers go so far as to sum up their experience by saying, "glancing at all the facts, it is evident that these wheats afford a larger margin of profit both to the miller and baker than any other."

The modes of cultivation adopted are of great interest. They usually exhibit vast pains, and are in this respect superior to the system of wheat-cultivation employed at home. Such elaborate cultivation would indeed astonish an English farmer accustomed to plough his lea land or turnip land once for wheat. The comparison is less fair if we take into consideration the fact that one thorough English ploughing may be worth half-a-dozen of those "ticklings" of the soil which, under Indian skies, are sufficient to make it "laugh." Under the head of Systems of Cultivation we read:—"Ploughed in July, and again six or seven times until October. Watered in November. Again ploughed twice, rolled, ploughed again, and the seed sown through a tube attached to a plough-handle. After twenty-five or thirty days, again watered; and this is repeated until the plants appear fortnightly where irrigation is by lift, and every twenty-five days where it is by flow. In February, when the ears have appeared, water is given weekly until the ears begin to mature." In Armritsar;—"Six months before sowing, the land is ploughed five to ten times. After sowing, the crops are watered not less than six or more than nine or ten times." In Gujrat:—"Land is broken up and ploughed many times between May and September, manured and ploughed and levelled." The average produce per acre after this system of cultivation varies from seven to fourteen or even twenty maunds (nine to twenty-seven bushels of 61 lbs.), and yet it is calculated that it is grown at from 8s. to 11s. per quarter! Wheat-growing appears to be carried on upon all sorts of soils. Upon stiff loams, sandy loams, hard clay, and "every kind of soil." In reply to the question, Has the productive power of the soil begun to fail? the answers are usually in the negative, or that it is not apparent. Still, as might be expected, better crops are grown upon manured and irrigated soils and upon those newly broken up from pasture.

After reading the details of wheat-cultivation in India and compared its results with those obtained in England with a fifth part of the labour, we are inclined to wonder greatly that this remote field should be able to compete with us. Why do they plough five to ten times? How is

it that in that sunny land, and after all this expenditure of labour and irrigation, twenty-seven bushels should be a maximum return, while in some cases seven bushels is all that is reaped? A painstaking farmer in England hopes for from thirty-two to forty bushels per acre after once ploughing and pressing his clover leys, and yet he cannot make both ends meet, nor yet compete with the Indian Ryot.

JOHN WRIGHTSON

THE REPORTS OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES FOR 1881 AND 1882¹

THE Report for 1881 was presented to the Senate and Congress of the United States on March 17, 1882; it is to be regretted that so long an interval was allowed to elapse before its publication. The volume is a large one, three inches in thickness, and containing nearly 1200 pages. Scarcely any of this large quantity of letterpress is without interest and value, and we here give an account of the work described in it.

The Commission began the second decade of its existence in 1881, and the present report shows how greatly the organisation has extended itself, and what large results it has achieved in its first ten years. The central offices of the Commission are at Washington, and up to the year 1881 were confined to the private residence of its public-spirited chief, Mr. Spencer Baird, who devoted the greater part of his house to the State service without remuneration. In 1881 a building was erected next to the Commissioner's residence, at the public expense, to provide space for the increased administrative work. The stations where the varied operations of the Commission are carried on are scattered throughout the United States territory. These operations fall naturally under three heads: (1) Economical statistics and historical data concerning the fishing industries; (2) the applied science of regulating fish supply and distribution; (3) the pure science of marine zoology. The part of the work belonging to the first of these divisions is conducted partly at the central offices, partly at the seats of the industries in question. The two other fields of work are, of course, not always distinctly separate. Since 1878 buildings at Fort Wharf, Gloucester, Mass., had been occupied for hatching operations, but in 1881 they passed into the possession of a private firm, since which time only reports on the fisheries and records of ocean and atmospheric temperatures have been obtained from Gloucester. The principal site of the purely scientific work during the summer season was Wood's Holl, Mass., where the Commission possessed a sea-side laboratory. Researches on the artificial propagation of oysters, &c., were carried on at St. Jerome, Md., near the mouth of the Potomac. Cultivation of the land-locked or Schoodic salmon was practised on the Grand Lake Stream, near Calais, Me. The Penobscot or Atlantic salmon (*Salmo salar*) similarly received attention at Buckport, Me. Another station, where lake trout, brook trout, California trout, &c., were hatched, was at Northville. The principal hatchery for the Californian salmon was on the McCloud River, a branch of the Sacramento. Shad eggs were hatched at Battery Island, Md., at North-East River, Md., near the mouth of the Susquehanna, at the Central Station, Armory Buildings, Washington, at Washington Navy Yard, on the Potomac river-barges, and at Avoca, N.C. Carp ponds were maintained at Monument Lot and at the Arsenal, Washington. The Commission acknowledges valuable assistance received from almost all departments of the Government, but especially from the Navy Office, which, in compliance with decrees of Congress, has detailed steamers fully manned and equipped, lent launches, and executed work and repairs at the navy yards. Steam

¹ Washington, 1884.

ship and telegraph companies have also aided in the work of the Commission.

Up till 1879 the Commission was not in possession of any vessel of considerable size: its explorations at sea were carried on by means of boats either hired or lent by the navy. In 1879 Congress voted money for the building of a steamer to be entirely devoted to the work of the organisation. This vessel was designed as a floating hatching station capable of being moved from place to place according to the season and the opportunities afforded, but she was not intended to go to sea in all weathers or to any great distance. She was named the *Fish-Hawk*, and was built at Wilmington, Del., from the designs of Chas. W. Copeland, consulting engineer of the Lighthouse Board. A very complete and interesting report is presented in the volume before us on the construction of the *Fish-Hawk* and the work performed by her in 1880; and another on her services in 1881. The *Fish-Hawk* is 156 feet long over all, 27 feet in the beam, and 7 feet 2 inches in draught at the stern. Her ordinary speed is about 9 knots an hour. The hull below the main deck is of iron, sheathed with yellow pine; above the main deck she is of wood. The hatching apparatus and machinery for working it are placed on the main deck immediately abaft the forecabin; the space thus set apart is 47 feet in length. On the after part of the main deck is the principal cabin, which contains the Commissioner's office. Above the main deck, extending from stem to stern, is a promenade deck, on which are the hoisting and reeling engine, the dredging boom, its heel attached to the foremast, and at the after end the naturalists' laboratory. The vessel is rigged as a fore and aft schooner, carrying a fore-staysail, a foresail and mainsail; she has four boats, the largest of which is a steam-cutter.

The *Fish-Hawk* has been found to fulfil admirably the purpose for which she was designed, viz. the economical and effective hatching of shad. But it had long been evident that the Commission required also a sea-going steamer to investigate the conditions and extent of the known, and to discover new, fishing-grounds, to ascertain the complete history of the migrations of food-fishes, to add, if possible, to the list of species available as food, and to study marine phenomena in general. The reward to be expected from this kind of work was indicated by the history of the discovery of the tile-fish, an entirely new species of which some specimens were brought in by a fishing-vessel in 1879. The *Fish-Hawk* made a trip to the place where the tile-fish was found, at the western edge of the Gulf Stream, and found that it was as abundant over a large extent of ground, as the cod is in other places. The area dredged over was found to be also in other respects a valuable fishing-ground, and extremely rich in all forms of life, many new and interesting species being discovered. The tile-fish has been found to be of great value as food when fresh, and to be as easily salted and preserved as the cod. In consideration of these facts Congress voted 103,000 dollars for the building of an ocean steamer for the work of the Commission, to be called the *Albatross*.

In 1881 the Commission began the publication of another annual volume in addition to its Report. It is called the Fish Commission Bulletin, and the first issue contained a memoir on the development of food-fishes, by John A. Ryder; one on the life-history of the eel, by G. Brown Goode; one on the salmon disease in English waters, by Prof. Huxley and S. Walpole; and other papers on fish-hatching and fisheries. Besides this were published in 1881 four census bulletins, and a volume of tables containing statistics of American fisheries, all prepared under the supervision of members of the Commission. In the latter part of the year a monograph on the oyster industry was issued by Mr. Ernest Ingersoll.

The results of the year's work in the three several departments already defined are given in three separate

appendices to the Commissioner's report. Those belonging to the first department are contained in Appendix B, which consists of six memoirs, only two of which refer to American fisheries. The first of these is on the history of the mackerel fishery, by Messrs. Brown Goode, Collins, Earll, and Clarke, and occupies nearly a third of the whole volume. It begins with an account of the natural history of the fish, and of its geographical distribution, by Mr. Brown Goode. He finds that the species (*Scomber scombrus*) is confined to the North Atlantic. Its southern limit on the American coast is Cape Hatteras, lat. 35°; its northern limit, the Straits of Belle Isle, lat. 52°, though stragglers may occur further north. Its northern limit on the European coast is North Cape, lat. 71°; its southern, the Mediterranean. The mackerel appears in large shoals on the American coast every summer; as yet it has not been ascertained where it passes the winter. Prof. Hind, who is a Canadian, believes that the fish hibernates in the mud, near shore. Mr. Brown Goode, with much greater probability, argues that the shoals move out to the deep ocean in autumn. He distinguishes between the littoral and bathic migrations of this and other species, and concludes that this fish, like others of similar habits, is influenced in its movements chiefly by temperature, food, and breeding instincts. The mackerel only remains near shore while the temperature of the water is above 40° F. Off Cape Hatteras mackerel first appear about March 20; in the Gulf of St. Lawrence they are not abundant till June. The shoals disappear in October, though occasionally some are caught in December. The mackerel spawn in water of 15 fathoms and less, and while spawning do not take bait, or rise to the surface. The eggs are pelagic, and the young fish grow to 6½ or 7 inches in the first season, probably reaching full size in four years. The mackerel's food consists chiefly of pelagic forms, but not so exclusively as in the case of the herring. A great deal of space is given in this account to the evidence of fishermen as to the food of the mackerel, but as no scientific interpretation is given of their somewhat vague descriptions, the reader does not learn much from the discussion. We conclude that the food consists largely of copepoda, crustacean larvæ, schizopoda, and pteropoda. One paragraph dealing with the food question is, to an English reader, somewhat amusing. The author says that the food of the mackerel is called in England the "mackerel-mint," and consists of "sand-lants [*sic*]" and five other species of fish. We are not sure, but we think "mackerel-mint" is a mistake for "mackerel-midge," which is the young of various species of rockling, but especially of *Motella tricirrata*. In the same paragraph it is said that mackerel have been seen to devour the swimming larvæ of tape-worms. The first chapter of the essay can only be regarded as a preliminary inquiry to serve as a basis for accurate investigation. It seems strange that Prof. Brown Goode and Mr. Baird should mention a mysterious membrane over the eye of the mackerel without giving the anatomical meaning of the membrane; and it is equally unsatisfactory to read an account of the dissection of a mackerel, quoted from Bernard Gilpin, in which the air-bladder and the aorta are mixed up. Next follows a history of the mackerel-fishery in the United States, from which we learn that since 1880 the purse-seine has come into general use for mackerel-catching. The mackerel fleet consists of 468 vessels, mostly of 60 to 80 tons, schooner rigged, and very fast sailers. The old method of hook-fishing is described fully in a historical chapter. Besides the purse-seine, gill-nets are also used in mackerel fishing at the end of the season, off the New England coast. The total catch of mackerel in 1881 off the United States coast is estimated at 294,667,000 fish.

Chapter III. of the essay contains an account of the legislation affecting the mackerel fishery. Even at the time of printing the Report in 1881, on account of the

clamours of the inshore fishermen against the purse-seine, a Committee of Senate was appointed, which was likely to result in additional regulative enactments. The rest of the essay contains an account of mackerel-canning, statistics of the fishery in 1880, the inspection laws, a chronology of the history of the fishing, a list of vessels engaged in the industry, and a table of the catch by American vessels in Canadian waters.

A paper by Mr. Harrison Wright relates the history of the shad fishery in the Vale of Wyoming, on the north branch of the Susquehanna. The Indians caught shad there before white settlers came, about 100 years ago. The white people used shad seines with great success until 1830, when the construction of dams for a canal put an end to the fishery altogether. There were about forty permanent fisheries, some of which had an annual catch of 10,000 fish, weighing three to nine pounds each. It is suggested that the fishery might be restored by the construction of ladder-ways over the dams, and other improvements, together with a restocking of the river with young shad.

A translation is given of a report on the Loffoden fishery in 1880 by Lieut. Niels Juel, the chief of the police administration, which has charge of public order, &c., at the fishery. This report is very interesting, but we have scarcely space to summarise it: we can only give a few of the prominent facts. The number of boats engaged varied from 1000 to 5000; the total number of fishermen was about 27,000, of whom about 13,000 fished with gill-nets, 10,000 with long lines, and 3000 with hand-lines. The author believes that the water-temperature most suitable for cod is between $3\frac{1}{2}^{\circ}$ C. and $4\frac{1}{2}^{\circ}$ C. The total yield of the fishery in 1879 was 25,000,000 fish, valued at 5,000,000 crowns. In 1880 the yield was still greater, being only surpassed by that of 1877.

Another paper in this appendix gives extracts from the official statistics of the Norwegian fisheries in general, and another is a transcript, from the London *Quarterly Review*, of an article on "The Fish-Supply of London." In the latter the opinion of very high authorities is quoted that the fisheries of the North Sea, small as its area is, are practically inexhaustible, and that trawling does not tend to exterminate any species of food-fish.

Appendix D deals with the propagation of food-fishes. It contains twelve papers, which are, with one exception, reports on the work of the various stations of the Commission during the year. The exception is a paper on the "Repopulation of the Water-Courses of Belgium," by Baron de Selys Longchamps. This essay shows how the waters of the Meuse and Scheldt have been rendered barren by the construction of dams and the pollution from factories; and that it will be a matter of great difficulty to remedy this state of things by the construction of fish-ways and the purification of the rivers.

The whole work of the Commission, from its institution in 1871 to 1880, is reviewed in a number of statistical tables prepared by Chas. W. Smiley. In the period in question 43,000,000 shad were artificially hatched and released on the spot, 53,000,000 successfully transported; 15,000,000 of Californian salmon have been hatched and released on the Pacific coast, 31,000,000 transported to other States, and 4,000,000 sent abroad. Of the 31,000,000 transported, about 50 per cent. were successfully introduced into distant waters. In 1879 and 1880 61,000 carp were distributed.

Then follow seven reports on the work of the various hatching-stations, in which occur, here and there, interesting accounts of experiments and inventions connected with the hatching apparatus. At Wood's Holl experiments were made with a view to arranging an apparatus suitable for hatching cods' eggs; the experiments were only partially successful. It was at Wood's Holl that Prof. Ryder carried on his researches into the embryology of the cod. Experiments on the artificial hatching of the Spanish mackerel were made at Cherrystone, Va.

Lastly, we have to notice Appendix C, on Natural History and Biological Research. First, we have an account of the Annelida Chaetopoda collected on the Massachusetts coast by the summer expedition of Union College. Three genera and sixteen species are described here as new to science. Of these *Thaumastoma* is said not to belong apparently to any known family. As far as we can judge from the figure of the head given, the genus is allied to the *Nereidæ*; but all the figures in the plates to this paper are rough and unsatisfactory.

Mr. Coutant records some experiments on the effect of saline solutions of the same strength as sea-water, but of different composition, on marine molluscs. In all cases the solutions were ultimately fatal; but it would be interesting to have these experiments repeated with some alterations; viz. the solution to be substituted for the sea-water gradually, instead of suddenly, and the natural conditions to be more nearly realised in all other respects save the composition of the medium.

Prof. J. A. Ryder contributes a paper on "The Importance of the Protozoa and Protophytes as the Primary Source of the Food of Fishes." He might have said simply Protophytes, since Protozoa are fed by these; and it is obvious, since a small proportion only of marine animals feed on littoral algæ, that marine life depends largely on pelagic Protophyta. The author reviews the evidence that most Entomostraca feed on Protozoa, and that these feed on diatoms, &c., while the Entomostraca constitute the food of vast numbers of fish. He gives evidence to show that the adult shad feeds while spawning, in fresh water, and that the newly hatched shad feed on exceedingly small and young Entomostraca. The paper is rather a popular essay than an original memoir.

S. A. Forbes finds that the earliest food of the young of *Coregonus albus* in Lake Michigan consists almost entirely of Copepoda of the species *Cyclops Thomasi* and *Diatomus sicilis*.

Prof. Ryder, in another paper, describes some successful experiments in retarding the development of shad ova. It was found impossible to develop them at 38° F. or at 45° F. Ova kept moist on flannel trays at 52° F. were killed by fungus, but the development proceeded at the rate of nine days for the embryonic period. In an experiment in which glass McDonald jars were used with water from the Potomac when the river was at the temperature of 51° F. to 57° F., development took place normally, and hatching was retarded till the thirteenth to the sixteenth day. The embryos were lost by accident, but the author thinks it would require about twenty-five days at this temperature to absorb the yolk, and thus, if the same success could be insured on board ship, there would be ample time to transport embryos to Europe.

Prof. Ryder's remarks at the end of this paper, on "The Rationale of Retardation" somewhat neutralise the satisfaction experienced in reading the account of his practical work. In the present state of science it is scarcely allowable to talk of the nucleus as a "directive dynamic centre," because the phrase has little definite meaning. It is not true that the division of a nucleus has been described by Flemming under the terms "systole" and "diastole"; that author's use of those words referred to certain alternating movements in a nucleus previous to its division. The division of the nucleus does not give us a complete explanation of the phenomena of retardation. It is a truism that retardation of development means diminution in the rapidity of the rate at which cell-divisions take place; but to talk of the *vis essentialis* of segmentation residing in the nucleus is about as instructive as an attempt to localise the horology of a clock, the *vis essentialis* of a steam-engine, or the situponability of a chair.

The Report for the year 1882 was published at the end of last year, only a few months after the issue of the volume for 1881. In some respects this, the most recent annual Report, is the most interesting of the whole series,

the year 1882 having been unusually eventful for the Commission. During that year the new ocean steamer *Albatross* was constructed, steps were taken towards founding a permanent station at Wood's Holl, the Armory Building at Washington was fitted up as the central station of the Commission, and the surprising fact came to light that the tile-fish, investigated a short time previously by the Commission, had been practically exterminated by unknown natural causes. Besides the history of these events the Report contains a long and elaborate memoir, by John A. Ryder, on "The Development of the Cod," which forms one of the most conspicuous features of the volume, and some interesting papers on the artificial propagation of the oyster: the rest of the volume is chiefly made up by the usual separate Reports of the various hatching-stations, and papers on American fishing industries.

The appropriation made by Congress for the *Albatross* in 1881 was too small, and it was not till March, 1882, that an additional grant was obtained, and the contract for her construction was signed. On November 11 the vessel was put into commission with Lieut. Z. L. Tanner, formerly commander of the *Fish Hawk*, as captain. On December 30 the *Albatross* left Wilmington, where she was built, for Washington, on a trial trip. Her total displacement is 1000 tons. A description of the vessel and of her equipment is promised in a subsequent Report. The arrangements for establishing the principal permanent sea-side station of the Commission at Wood's Holl made some progress during the year, but were not completed. An agreement was made upon the conditions of the purchase of the requisite land, and all the necessary technical formalities arranged; but it was essential that there should be constructed within the great harbour of Wood's Holl an inner harbour, which would serve for a harbour of refuge as well as for the purposes of the Commission. An appropriation of 52,000*l.* for the new harbour was granted by Congress, but the President decided to defer action upon this and other new items in the harbour bill, and, consequently, the establishing of the Station was delayed for a time. Nevertheless, Wood's Holl was made the head-quarters of the general summer work of the Commission, and a large party were engaged there during July and August working at marine zoology and exploration. The *Fish Hawk* was stationed there during this time.

The central station at Washington was fitted up with shad-hatching apparatus, and was used as the centre from which all young shad hatched on the rivers Potomac and Susquehanna were distributed: the extreme limit of distribution was the Colorado river in Texas. The number of shad fry distributed was over 20,000,000.

The curious history of the tile-fish (*Lopholatilus chamaeleonticeps*), into the distribution of which researches were made in 1881, is related in a report by Capt. Collins in Appendix B. At the beginning of Capt. Collins's paper an account of the fish itself is given, from which we learn that it belongs to the family Latilidae, Gill, the representatives of which are mostly inhabitants of tropical seas and of shallow water. The ground where the tile-fish had been found lies between the latitudes of Hatteras and Nantucket, in long. 70° to 71°, about 100 miles off shore, at a depth of 90 to 125 fathoms. In March and April, 1882, vessels arriving at the principal Atlantic sea-ports reported the extraordinary occurrence of vast numbers of large dead and dying fish floating on the surface of the sea over the region where the tile-fish had been found. It was ascertained that a large proportion of these dead fish were tile-fish. In order to determine the extent of the destruction, a steamer was chartered by the Fish Commission, and sent out to the tile-fish ground in September. Not a single *Lopholatilus* could be obtained, but a new fish belonging to the genus *Setarches* was discovered, which promised to be of

importance as a food-fish. An account of this exploring cruise was published in the Fish Commission *Bulletin* for 1882.

Prof. Ryder's memoir on the development of the cod is founded on researches made at Wood's Holl, Mass., in June, 1881, and at Fulton Market, New York, in February, 1882. On the former occasion an apparatus devised by Marshall MacDonald was used, and about 5000 young fry were set free at Wood's Holl, and 25,000 sent to Chesapeake Bay and liberated there; these were all the fry obtained from several millions of eggs artificially fertilised. The memoir is a long one, extending to more than 100 pages, and is illustrated by twelve plates of woodcuts. This is the first publication in which the development of the cod has been described in detail and figured; the description given by Sars in his report to the Norwegian Government some years ago having been rather general, and not illustrated. The facts are given in Prof. Ryder's paper for the most part with great accuracy and fidelity, although the appearance of the woodcuts is not very pleasing, and the more complicated of the figures are a little wanting in clearness. The theoretical part of the paper will not commend itself to those who have accepted the generalisations of embryology at present prevalent. For example, it is stated that in Teleosteans, at an early stage, the body-cavity and segmentation-cavity are continuous; but the evidence produced in support of this revolutionary proposition is not by any means conclusive. It cannot be said that the obscurities of Teleostean embryology, such as the invagination of the gastrula, or the development of the genital ducts, are much illuminated by Prof. Ryder's memoir: on the latter point no information is given.

Two other interesting papers are included in the Appendix for Natural History and Biological Research: one by Sidney J. Smith on the Decapod Crustacea from the dredgings of the *Albatross* in 1883, and the other by Prof. Verrill on the fauna of the tile-fish ground at the western edge of the Gulf Stream. The former of these is an extremely elaborate memoir, accompanied by ten plates of clear and well-executed woodcuts, illustrating species and structures which had not before been sufficiently figured. The paper contains a great number of new species and several new genera: each new species is described with wonderful minuteness, and, a long table of measurements being added to each description, no one having occasion to use this memoir will be able to complain of inexactness or incompleteness in the characterisation of specific distinctions.

The paper of Prof. Verrill is short, being simply intended to indicate the most interesting features of the peculiar area investigated. It was found in the operations of 1882 that the vertebrate fauna, discovered to be so unusually abundant in 1881, had, like the tile-fish, suffered great destruction in the interval between the two seasons. This was especially the case among the Crustacea, some species, which had been taken in thousands at a single haul, having become extremely scarce. Prof. Verrill believes the remarkable destruction of life had been caused by a very severe storm which occurred in the spring of 1882, and which probably forced out the cold coast water over the Gulf Stream slope.

The whole of Appendix D has reference to oyster culture. It contains six memoirs, two of which describe experiments on the artificial propagation of the American oyster, *Ostrea virginica*. Lieut. Francis Winslow studied the subject at Beaufort, N.C., and at Fair Haven, Con.; Prof. Ryder at St. James's Creek, Md. In both cases, though a fair amount of success was obtained in impregnating the ova and keeping the embryos alive in the free-swimming stage, no satisfactory method was discovered of obtaining a supply of attached spat with any certainty. Prof. Ryder and Col. MacDonald on one or two occasions found that their embryos had fixed themselves to the sides

of their aquaria in large numbers, but they could not keep them alive more than a day or two after the attachment had taken place.

The growing extent of the piscicultural operations of the Commission, as indicated by the Reports in Appendix E, is marvellous. Statistics of the distribution of shad-fry during 1882 are given in a paper by Chas. W. Smiley; the total number distributed was over 30 millions. The total number of carp distributed was 259,000, of Penobscot salmon 1,716,000, of Schoodic salmon 1,482,000.

It would be extremely interesting to have some information as to the result of all this work, as to the effect produced on the supply of fish in the rivers, and on the productiveness of the fisheries. The Commissioner points out that it is of little use to put anadromous fish into rivers if the waters are obstructed by dams or made uninhabitable by pollution, and a new fish-way to remedy the former difficulty is described by Col. M. MacDonald in Appendix A. But all who are acquainted with the labours of the American Commission would be grateful if Mr. Chas. Smiley would apply his great power of handling statistics to exhibiting the economical results of the piscicultural work.

J. T. CUNNINGHAM

NOTES

THE statue of Darwin will be unveiled in the great hall of the Natural History Museum, Cromwell Road, on Tuesday, June 9, at 12 o'clock, when Prof. Huxley, President of the Royal Society, on behalf of the memorial committee, will formally transfer it to the care of the Masters of the Museum, who will be represented by His Royal Highness the Prince of Wales. Places will be reserved for the committee and subscribers to the memorial, but the greater part of the hall will be open to the public during the ceremony. The statue, which has been executed by Mr. Boehm, R.A., is of marble, and seated, rather larger than life-size; it is pronounced by those who have seen it to be an admirable likeness as well as a fine work of art.

It is now twenty-one years since the *Geological Magazine* was first issued. During all that time Dr. H. Woodward, F.R.S., has been an editor, and for almost the whole of it the principal editor, on whom the main burden and chief responsibility of the work has fallen. It has been a work which has not only cost him much time and labour but also has been practically unremunerative. His friends among geologists accordingly purpose to celebrate the "majority" of the *Magazine* by presenting to him a testimonial in appreciation of his services to science. A meeting was held last week, at which an influential committee was formed, a list of which will shortly be circulated. The treasurer and secretary is Dr. Hinde, F.G.S.

We greatly regret to record the death of the Rev. Thomas W. Webb, Vicar of Hardwick, near Hay, Brecon, well-known for his writings on astronomical subjects. We hope next week to refer to the work he has done in astronomy.

THE death is announced of Mr. Peter William Barlow, F.R.S., the well-known engineer.

A CONGRESS on hydrology and climatology will, it is stated, be held at Biarritz during October next. The French Government has brought the matter to the notice of foreign Governments, in order that the latter may take the necessary steps to be represented at the congress.

ON April 13 the Leander McCormick Observatory attached to the University of Virginia was opened by public ceremony. The buildings are situated on a hill called "Observatory Mountain," because in 1825 Thomas Jefferson erected a small observatory there, which gradually fell into decay. They consist of residences for the director and assistant, offices, a small

observatory for minor observations, and a large building for the dome. The observatory proper consists of a cylindrical building surmounted by a hemispherical dome forty-five feet in diameter, and a rectangular building used as a library and computing office. The walls are of brick, the circular portion being heavily buttressed, and bearing at the top a coping of Ohio stone. On this rests cast-iron rails, on which the dome revolves. The latter weighs 25,000 lbs., and is composed of a framework of steel covered with galvanised iron and lined with painted canvas, having three openings covered by shutters when not in use. It takes five seconds to open one of these, and a minute and a quarter to revolve the dome quite round. The telescope, which is mounted on a brick pier under the centre of the dome, is similar at the Washington Observatory. The clear aperture of the object-glass is twenty-six inches. Like so many other important scientific and educational institutions in the United States, this observatory is due to the generosity of a wealthy native of the State, Mr. Leander McCormick, from whom it takes its name. This gentleman presented both telescope and building to the University. The cost is stated to have been about 13,000*l.*, the telescope costing over 9000*l.* The directorship of the observatory, to which post Mr. Ormond Stone, director of the Cincinnati Observatory, has been elected, is endowed with a sum of 10,000*l.*, collected by public subscription; while Mr. W. H. Vanderbilt has given the University a further sum of 5000*l.* as an endowment to pay the salary of an assistant observer, the expenses of publication, &c. According to the founder's plan the observatory is not to be confined to purposes of the University alone, but for general scientific research, so that students from any part of the United States who desire to become professional astronomers may receive a thorough training there. In accordance with this plan the Professorship of Astronomy in the University is a wholly distinct post from that of Director of the Observatory. Prof. A. Hall, of the National Observatory at Washington, delivered the opening address, taking for his theme "The Instruments and Work of Astronomy."

FROM various publications which we have recently received from the Government of Hong Kong Dr. Doberck, the astronomer, appears to have lost no time in employing the new observatory. The last batch of observatory papers include observations on lunar transits across the meridian of Hong Kong, and on the height of Victoria Peak. As this eminence is the most important in the east (with the possible exception of Fujiyama) in one sense—the sense in which Richmond Hill is more interesting than Mount Everest—it may be added that the mean height of the peak is 1710·6 feet above the Observatory, or 1818 feet above the mean sea-level. There is also a report on five-day means of the principal meteorological elements for 1884, constructed according to the recommendations of the International Meteorological Congress, and a complete weather report for the same year. With four well-equipped observatories (Tokio, Shanghai, Hong Kong, and Manila) at work, the meteorology of the China Seas will soon cease from being the sealed book which it practically is at present.

LAST year was a tolerably productive one for the collectors of prehistoric remains in Switzerland. The water of the lakes was almost constantly below the highest level, which is the most favourable state of things for explorations around the lake-dwellings. The remains discovered belong mostly to the Bronze period, and the chief localities in which they were found were Lake Neuchâtel and the settlement of Wallishofen near Zürich, the latter of which is the only station of the Bronze period yet known in Eastern Switzerland. Among the most remarkable articles discovered at this settlement in 1884 were a splendidly preserved bronze sword, several dozens of bronze hatchets, bracelets, &c. Of the remains of the Stone period discovered in